

On the Comovement of REIT Prices

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Abstract

This study examines the comovement of equity real estate investment trust (REIT) prices in both the vintage (1980–1991) and the new (1992–2004) REIT eras. The results indicate that the comovement of equity REIT prices within the same property type has strengthened during the new REIT era. The results also indicate that, all else being equal, a high institutional participation, a low insider ownership, and a large market capitalization are associated with a high within-property-type price synchronicity. The evidence is consistent with two notions: (1) that increasing participation by institutional investors in the new REIT era facilitates the pricing of property-type common information on firm-level prices, and (2) that REITs' information openness to institutional investing plays a role in this strengthened pricing relationship.

During the past years, asset markets have experienced considerable price fluctuations. While asset markets have been characterized by excess volatility, it is not clear whether price comovement among assets has become more or less intense. For example, Brooks and Del Negro (2004) find that the price comovement across national stock markets has risen since the mid-1990s. In contrast, Campbell, Lettau, Malkiel, and Xu (2001) document a decrease in the price comovement among firms in the United States.

In light of these recent findings, this paper asks the following questions: Has the price comovement among real estate investment trusts (REITs) become more (or less) intense over time? And, what may cause the change in the price comovement among REITs? Answers to these questions naturally have implications on portfolio selection and asset pricing of REITs. For example, if REITs belonging to the same property type have become more co-moved over time, the evidence would suggest a possible emergence of common industry factor(s) for REIT prices. This would also suggest that diversification among REITs is more effective today if it is first done at the property-type level.

Despite the above-mentioned importance and implications, it is surprising to note that relatively little is known about the comovement of real estate prices. Two exceptions are Ambrose, Lee, and Peek (2007) and Kallberg, Liu, and Pasquariello (2008). Ambrose, Lee, and Peek document that, when REITs are included in the

S&P 500 Index, the price comovement between indexed REITs and stocks increases and so does the comovement between non-indexed REIT prices and stock prices. Kallberg, Liu, and Pasquariello investigate the comovement among Case-Shiller Home Price Indices for 14 metropolitan areas and find that the degree of comovement in these markets increased over the January 1987 to March 2008 period.

This study develops hypotheses under the classical view of price comovement that security prices move together to reflect common information (Roll, 1988). Within this paradigm, the REIT sector provides a good opportunity for investigating the impact of information flow on comovement. It is well known that REITs experienced a structural change in the early 1990s (Crain, Cudd, and Brown, 2000; Glascock, Lu, and So, 2000). Prior to the Revenue Reconciliation Act of 1993, REITs were bounded by a 5/50 ownership restriction, which required that no fewer than five individuals/institutions could own more than a combined 50% of shares outstanding of a REIT. The 1993 act modified the restriction and allowed institutions to count all of their own investors as individuals for REIT investing. The 1993 act, thus, effectively increased the scope of participation by institutions. Wang, Erickson, and Chan (1995) document that institutional ownership in REITs between 1979 and 1984 ranged from 6.66% to 8.41%. By 1995, institutional participation had quickly increased to 30%, according to Chan, Leung, and Wang (1998). Because institutional investors are better informed to incorporate more systematic information into security prices, one would expect different comovement structures before and after the structural change.

In addition to institutional participation, the firm characteristics of REITs may have implications on the relationship between information flow and price comovement. In general, REITs exhibiting information openness to institutional participation should have more informative share prices; that is, their share prices may contain a higher degree of systematic information. For example, REITs that are preferred holdings of institutional investors are hypothesized to exhibit more systematic information in their prices. Furthermore, one would expect that information asymmetry—as frequently measured by insider ownership, market capitalization, and firm age—has negative effects on the relationship of institutional participation to REIT price comovement.¹

This study finds evidence suggesting that REIT comovement structure evolved around the targeting-strategy enactment period. Specifically, this study finds that the comovement of equity REIT prices within the same property type strengthened during the new REIT era, 1992–2004.² The results further suggest that this type of tightened comovement is unlikely to be explained by changes in fundamentals. A natural, plausible explanation for this, therefore, is that institutional participation in the new REIT era facilitates the price discovery of property-type information. That is, institutional investors appear to pay more attention to property-type information than do individual investors, and that their activities improve the ability of systematic (property-type) information to explain REIT-level prices.

This study also finds that, at the individual REIT level, a REIT that has a low institutional participation, has a small market capitalization, and is overwhelmingly owned by insiders tends to have a low within-property-type price synchronicity. The result suggests that information flow is important to REIT pricing and price comovement in that information asymmetry plays a role.

Hypotheses

It is well known that securities tend to move together when they are perceived to be in the same category (Barberis and Shleifer, 2003; Barberis, Shleifer, and Wurgler, 2005; among many others). This common sensitivity to common factors, in turn, may help explain asset returns (Barberis and Shleifer, 2003). Because of their unique hybrid nature, REITs are widely accepted as a distinct category.

This study hypothesizes that the comovement structure of REIT returns before December 1991 is different from the comovement structure of REIT returns after January 1992. The enacted change in the ownership restrictions included in the Revenue Reconciliation Act of 1993 made large-scale investments in REITs more desirable to institutional investors. Because of increasing participation by institutional investors in the new REIT era, one would expect better information transfer and sharing among REITs. Overall, this hypothesis is a natural extension of the well-documented empirical relationship between information flow and institutional participation. Piotroski and Roulstone (2004) demonstrate that institutional participation facilitates firm-specific price discovery. Bradrinath, Kale, and Noe (1995) argue that institutional investors provide information services and that their participation affects price behavior and comovement. Furthermore, we conjecture that this change in comovement structure should be particularly true among those REITs within the same property type. It is well documented that different property types appear to be influenced by different sets of fundamentals and exhibit distinct price patterns (Gyourko and Nelling, 1996; Gallo, Lockwood, and Rutherford, 2000).

The hypothesis is derived under the classical information-based paradigm of price comovement. We formulate our hypothesis under the classical paradigm for two reasons. First, this line of reasoning is natural because the structural change in the early 1990s has an impact on information flow. Second, the hypothesis fits better into the existing REIT literature in which information services provided by institutional investors and financial advisors are well documented (Clayton and MacKinnon, 2000; McDonald, Nixon, and Slawson, 2000; Daniels and Phillips, 2007; Lee, Lee, and Chiang, 2008).

In addition, the study hypothesizes that a REIT's price synchronicity relative to its property type is a function of its information openness to institutional participation. That is, all else being equal, if a REIT has a low degree of information asymmetry and the REIT is preferred by institutional investors, its

share price should contain a high degree of systematic information and a high price synchronicity relative to its property type. Using stock market data, Pirinsky and Wang (2004) find that the comovement of stock prices with the market is positively related to their level of institutional ownership.

This study uses the following variables to capture information openness: insider ownership, market capitalization, and firm age. Wei, Hsieh, and Sirmans (1995) find that information asymmetry and conflicts of interest within REITs are priced. Insider ownership is used by the authors to proxy for information asymmetry and conflicts of interest. Market capitalization and firm age are drawn from existing studies to proxy for information openness. It is widely accepted that large-cap firms and established firms have lower transaction costs and lower information asymmetry.

Although our hypotheses are derived under the classical paradigm of price comovement, there are many alternative explanations of comovement; e.g., style investing (Barberis and Shleifer, 2003), wealth effect (Ghosh, Guttery, and Sirmans, 1998; Kyle and Xiong, 2001), financial constraints (Yuan, 2005), portfolio rebalancing activities (Kodres and Pritsker, 2002), and strategic trading (Pasquariello, 2007). Empirically, the difficulty for sorting out these alternative explanations in this study, and other studies, is that these potential explanations are seldom mutually exclusive. According to Kallberg and Pasquariello (2008), no “horse race” among these alternative explanations has yet emerged to ascertain their relative importance and usefulness in explaining comovement. Because of these limitations, we acknowledge that the results from our information-based hypotheses should be carefully qualified in the context of this vast, intertwined literature.

Data

This study uses the Center for Research in Security Prices (CRSP)/Ziman Real Estate Database. The sample period is from January 1980 to December 2004. This study focuses on equity REITs. Monthly returns and annual dividends on all equity REITs, along with their concurrent property type classifications, during the sample period are retrieved from the CRSP/Ziman Database. This study next collects monthly returns on the following CRSP/Ziman property-type value-weight indices: health care, industrial/office, lodging/resorts, residential, retail, and self-storage.

Accounting/market data for individual equity REITs, including year-end market capitalizations, insider ownership, and book-to-market ratios, is retrieved from the SNL Financial Database. To study the relationship between within-property-type synchronicity and institutional participation, we obtain the REIT ownership data used by Chiang, Ong, Wisen, and Zhou (2009). The authors identify *distinct* real estate mutual funds and collect their annual REIT holdings over the 1996–2007 period. This study uses real estate mutual fund ownership as a proxy for

institutional participation/ownership. The study does not use the institutional ownership data from the SNL Financial Database because the data series only goes back to 2004. Many databases, including the SNL Financial, count the same holdings more than once when an institutional portfolio has multiple classes. As a result, some of the institutional holding observations from commercial databases have a value that is 100% or greater.

Statistical Methods

To gauge comovement, this study follows the suggestion of Solnik and Roulet (2000) and uses instantaneous volatility/dispersion measures. According to the authors, a large dispersion of individual returns indicates that the market is not moving together, and vice versa. In real estate literature, Plazzi, Torous, and Valkanov (2008) use a similar volatility/dispersion measure. The difference between these authors' research design and ours is that they use these measures to capture the risk faced by commercial real estate investors, whereas we use these measures to gauge return comovement and synchronicity.

Specifically, for each month, we calculate the following synchronicity measure, based on all available equity REIT monthly returns, $\{R_{ij}\}$, within the same property type, j :

$$VOL_j = \sqrt{\frac{\sum_i (R_{ij} - \bar{R}_j)^2}{N_j - 1}}, \quad (1)$$

where $i \in j$, and N_j is the number of equity REITs in that property type in that month. A high VOL_j indicates a low degree of within-property-type comovement, and vice versa.

This calculation is repeated using the monthly returns on the CRSP/Ziman property-type indices:

$$VOL = \sqrt{\frac{\sum_j (R_j - \bar{R})^2}{N - 1}}, \quad (2)$$

where R_j is property-type return, and N is the number of equity REIT property types in that month. A high VOL indicates a low degree of between-property-type synchronicity, and vice versa.

Once return synchronicity measures are obtained, this study uses Vogelsang's (1998) $t\text{-}PS_T^1$ test to check for a deterministic trend in the times series of these measures. Chiang, Lee, and Wisen (2005) use this method to examine the time-series properties of REIT betas. The $t\text{-}PS_T^1$ test is based on the following specification:

$$\hat{b}_t = \alpha + \beta t + \mu_t, \quad (3)$$

where \hat{b}_t is the time-series of synchronicity estimates, α is the initial level of \hat{b}_t , β is the average slope of time trend in \hat{b}_t , and μ_t is a serially correlated random process. Testing for a time-trend in synchronicity estimates focuses on whether β is different from zero. The $t\text{-}PS_T^1$ test statistic is specified as:

$$t\text{-}PS_T^1 = T^{-1/2} t_z \exp(-cJ_T), \quad (4)$$

where T is the sample size, t_z is the set of t -statistics for testing the null hypothesis that the individual parameters in the partial-sums regression of $\hat{b}_t = \alpha + \beta t + \mu_t$ are zero, c is a constant, and J_T is a unit root statistic. Because the asymptotic distribution of the $t\text{-}PS_T^1$ statistic is non-normal, statistical inferences are based on the critical values tabulated in Vogelsang.

Empirical Results

Time Trend in Return Comovement

Exhibit 1 reports summary statistics on the average returns of the six CRSP/Ziman property-type value-weighted indices during the period 1980–2004. As shown, the returns are quite different, ranging from 0.44% per month to 1.29% per month. The correlation structure among the six property types shows that their return behaviors are quite distinct. The correlation coefficients range from 0.3843 to 0.7155.

Exhibit 2 reports test results on time trends in return comovement for the periods 1980–1991 and 1992–2004. Panel A shows that, during the vintage REIT years, 1980–1991, within-property-type synchronicity decreases slightly over time. The VOL_j measures for health care REITs have a linear trend estimate of 9.23×10^{-4} . This decrease in return synchronicity within the health care property type is statistically significant at the 5% level. The linear trend estimates for the other five property types are also positive, but their values are not statistically significant at any conventional level.

Exhibit 1 | Summary Statistics on Average Returns of Six Property-Type Value-Weight Indices, 1980–2004

	Health Care	Industrial/ Office	Lodging/ Resorts	Residential	Retail	Self- Storage
Panel A: Means (Standard Deviations)						
	1.29%	0.86%	0.44%	1.19%	1.29%	1.18%
	(4.49%)	(5.20%)	(7.53%)	(4.86%)	(4.08%)	(5.55%)
Panel B: Correlation Coefficients						
Health Care	1.0000					
Industrial/Office	0.4186	1.0000				
Lodging/Resorts	0.4462	0.5258	1.0000			
Residential	0.5261	0.6279	0.4031	1.0000		
Retail	0.6332	0.6423	0.4419	0.7155	1.0000	
Self-Storage	0.4671	0.5996	0.3843	0.4179	0.5282	1.0000

Panel B of Exhibit 2 shows that within-property-type comovement has a different structure in the new REIT era. During the more recent sub-period, 1992–2004, the linear trend estimates of VOL_j for the six property types are all negative. This result implies that there is a higher degree of comovement within the same property type in the new REIT era. A direct implication of the result is that diversification among REITs is more effective today if it is first done at the property type level. Specifically, the linear trend estimates for industrial/office and self-storage property types are statistically significant at the 1% level. The linear trend estimate for residential property type is statistically significant at the 5% level. The linear trend estimate for the lodging/resorts property type is statistically significant at the 10% level. The VOL_j estimates of health care and retail property types are not statistically significant at any conventional level.

Overall, the results reported in the first two panels of Exhibit 2 are consistent with our hypothesis that the within-property-type comovement structure of REIT returns before December 1991 is different from that after January 1992. It appears that, within the classical information-based comovement paradigm, the Revenue Reconciliation Act of 1993 promotes participation by institutional investors in the new REIT era, and this participation improves information transfers.

Gallo, Lockwood, and Rutherford (2000) argue that different property types are influenced by different sets of information flows and/or fundamentals. If our hypothesis is correct, increased participation by institutional investors in the new REIT era would thus contribute relatively little to the improvement of information transfer between property types. The test results in Panel C of Exhibit 2 are

Exhibit 2 | Test Results on Time Trends in Return Comovement for the Six Property-Type Value-Weight Indices

		$t-PS_t^i$		
	Linear Trend ($\times 10^{-4}$)	10% Significance (1.33)	5% Significance (1.72)	1% Significance (2.65)
Panel A: Within-Property Type, 1980–1991				
Health Care	9.23	3.38*	3.14*	2.43
Industrial / Office	0.53	0.52	0.55	0.68
Lodging / Resorts	9.35	1.13	1.04	0.79
Residential	1.40	0.85	0.94	1.33
Retail	0.89	0.88	1.00	1.59
Self-Storage	3.23	0.60	0.46	0.18
Panel B: Within-Property Type, 1992–2004				
Health Care	−0.14	−0.52	−0.56	−0.76
Industrial / Office	−7.99	−4.43*	−5.20*	−9.15*
Lodging / Resorts	−5.09	−1.44*	−1.61	−2.41
Residential	−4.45	−1.89*	−1.98*	−2.36
Retail	−0.52	−0.31	−0.36	−0.62
Self-Storage	−0.94	−1.66*	−1.93*	−3.32*
Panel C: Between-Property Type				
1980–1991	1.05	0.07	0.08	0.10
1992–2004	−0.45	−0.41	−0.45	−0.65
Note: *Denotes statistical significance.				

consistent with this conjecture. The time trend estimates for the *VOL* estimates between the six property types are not statistically significant at any conventional level.

Fundamental Comovement

Within-property-type synchronicity can be due to a better sharing of property-type-wide information and/or fundamental synchronicity. Does the documented time trend in within-property-type return synchronicity simply reflect an increase in fundamental comovement? To check for this, this study collects dividends data

for the 1992–2004 period from the CRSP/Ziman database. Dividends are used to gauge the fundamentals of REITs because REITs are widely perceived as yield instruments (Glascok, Lu, and So, 2000). The REIT literature has also shown that dividend discounting models work well for REIT prices (Kallberg, Liu, and Srinivasan, 2003).

The test results of within-property-type dividends comovement are reported in Exhibit 3. These tests use dividends, instead of returns, to compute VOL_j estimates.³ The results indicate that the documented increased within-property-type return comovement cannot be explained by changes in the comovement of fundamentals. Industrial/office, lodging/resorts, residential, and self-storage property types yield *positive* time trend estimates during the new REIT era. Health care and retail property types yield negative time trend estimates, but neither of them is statistically significant.

The Determinants of Comovement

What might be the sources of within-property-type synchronicity? We address this question by studying the relationship between an individual REIT's synchronicity and its market/accounting characteristics.⁴ For each year, we construct the flowing measure of deviation from within-property-type synchronicity for each equity REIT:

Exhibit 3 | Time Trends in Within-Property-Type Dividends Comovement for Six Property-Type Value-Weight Indices

	Linear Trend ($\times 10^{-4}$)	$t-PS_t^j$		
		10% Significance (1.33)	5% Significance (1.72)	1% Significance (2.65)
Health Care	−0.41	−0.37	−0.45	−0.88
Industrial/Office	10.60	2.36*	2.37*	2.42
Lodging/Resorts	5.51	1.07	0.97	0.67
Residential	8.97	3.64*	3.83*	4.61*
Retail	−20.00	−1.20	−1.23	−1.35
Self-Storage	17.95	3.96*	3.68*	2.83*

Note:
* Denotes statistical significance.

Exhibit 4 | The Determinants of Within-Property-Type Return Synchronicity, 1997–2004

Intercept	0.0547 (17.57)**	0.0500 (8.87)**	0.0492 (14.53)**	0.0506 (16.45)**	0.2302 (16.60)**	0.0580 (16.59)**	0.0499 (12.06)**	0.0608 (14.75)***	0.2512 (15.53)**
OWN	(−3.18)** −0.0533								−0.0311 (−2.02)*
IN1		0.0005 (0.44)							0.0004 (0.40)
IN2			0.0004 (2.27)*						−0.0005 (−2.43)*
IN3				0.0006 (4.27)**					0.0003 (2.15)*
SIZE					−0.0139 (−13.37)**				−0.0145 (−12.92)**
DIV						−0.0038 (−3.71)**			−0.0004 (−0.43)
AGE							0.0000 (0.79)		0.0000 (0.08)
BM								−0.0213 (−3.60)**	−0.0276 (−4.81)**
R ²	0.0100	0.0002	0.0051	0.0178	0.1513	0.0135	0.0006	0.0128	0.1791

Notes: The dependent variable is the deviation from within-property-type synchronicity. The explanatory variables include mutual fund ownership (OWN), the natural logarithm of market capitalization (SIZE), the number of available monthly returns (AGE), book-to-market ratio (BM), annual dividends (DIV), and three piece-wise insider ownership variables with breakpoints of 0%–5% (IN1), 5%–25% (IN2), and >25% (IN3). The sample size is 1,005 firm-years. The results are based on two-way random-effect regressions. The *t*-statistics are in parentheses.

*Denotes statistical significance at the 5% level.

**Denotes statistical significance at the 1% level.

$$NO_SYN_i = \sqrt{\frac{\sum_t (R_{ij,t} - \bar{R}_{j,t})^2}{T_i - 1}}, \quad (5)$$

where $R_{ij,t}$ is the monthly return of i in property type j in month t , T_i is the number of available monthly return of i in that year, and NO_SYN_i is calculated only if T_i is greater than one. A high NO_SYN_i indicates a low degree of within-property-type synchronicity, and vice versa.

Our empirical strategy is to use the REIT's previous-year market/accounting variables to explain (predict) the variation in NO_SYN_i . In this study, the independent variables include mutual fund ownership (*OWN*) of Chiang, Ong, Wisen, and Zhou (2009), the natural logarithm of market capitalization (*SIZE*), the number of available monthly returns (*AGE*), book-to-market ratio (*BM*), annual dividends (*DIV*), and three piece-wise insider ownership variables with breakpoints of 0%–5% (*IN1*), 5%–25% (*IN2*), and >25% (*IN3*).⁵

This analysis of panel data is performed for the period 1997–2004 because the *OWN* data series starts in 1996.⁶ The sample size is 1,005 firm-years. Exhibit 4 reports the two-way random-effect test results.⁷ Both univariate and multivariate test results show that NO_SYN_i has statistically significant exposures to *OWN*, *IN3*, *SIZE*, and *BM*. These variables are at least statistically significant at the 5% level. In the multivariate test, their coefficients are -0.0311 , 0.0003 , -0.0145 , and -0.0276 , respectively. In other words, a low institutional participation, a high insider ownership, a small market capitalization, and a low book-to-market ratio yield a low within-property-type price synchronicity. Overall, the evidence is consistent with our hypotheses that information openness plays a role in the strengthened within-property-type comovement.

Conclusion

This study adds to the literature by documenting different within-property-type return comovement structures in the vintage and new REIT eras. Because of information transfers among sophisticated participants, REIT firm-level prices appear to be better related to property-type common information in the new REIT era. Furthermore, the study finds evidence suggesting that information openness adds to the price discovery of property-type information.

We would like to acknowledge that there are competing theories to the rise of the comovement within REIT property types. We believe that our results could be improved in the future once a “horse race” among competing theories can be empirically established, and that future research in this direction should be fruitful.

Endnotes

- ¹ Danielsen and Harrison (2000) find that private information affects the liquidity of the market for REITs. Below, Kiely, and McIntosh (1995) argue that institutional investors place greater emphasis on signals transmitted by informed investors.
- ² The concepts of new and vintage REIT eras are discussed in Downs and Patterson (2005).
- ³ This study also uses dividend yield, instead of dividend, as an alternative measure of fundamentals. The unreported results also show that within-property-type return comovement cannot be explained by within-property-type fundamental comovement.
- ⁴ We thank an anonymous referee for pointing out the need to address these possible sources.
- ⁵ See Friday, Sirmans, and Conover (1999) for the construction of the three insider ownership variables.
- ⁶ To control for the effects of fundamental factors on within-property-type return synchronicity, this study performs another set of analysis that also includes the concurrent values of the following four annual factor series: the excess return on the CRSP value-weighted portfolio net of T-bill rate, the difference between the returns on portfolios of small and big stocks, the difference between the returns on portfolios of high book-to-market stocks and low book-to-market stocks, and the difference between the returns on portfolios of winner and loser stocks. The unreported results are qualitatively similar.
- ⁷ The study experiments with one-way and fixed-effect error structures. The unreported results are qualitatively similar.

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